

## PALM PAD SYSTEM

### RELATED APPLICATIONS

This application claims priority from Provisional Application No. 60/114,521 filed December 31, 1999 and Provisional Application No. 60/135,894 filed May 26, 1999 both of which are herein incorporated by reference.

### FIELD OF THE INVENTION

The present invention relates to a method and apparatus for providing electronic storage and retrieval of handwritten notes. More particularly, it relates to a method and apparatus for providing electronic storage and retrieval of handwritten notes, along with other drawings, in an electronic device such as a personal digital device (PDD).

### BACKGROUND

Personal digital devices ("PDD") have become extremely popular for recording, storing and retrieving information. Examples of PDDs include personal computers, such as laptop computers and handheld computer devices having a display area and an input area. In one version of a handheld computer device, a user inputs information in the input area by writing with a specialized pen. The pen does not mark on the input area, but the PDD converts the writing to electronic information through a resistive contact surface. According to a common version of a PDD, the user writes in a specialized manner to represent alpha-numeric characters. Movement of the pen on the resistive contact surface is recognized by the PDD and converted into a corresponding character. Each character is created at the same location on the resistive contact surface. The characters are then displayed in the display area of the PDD. Depending upon the operation of the PDD the characters are stored in various formats to record information, such as names, addresses, telephone numbers, appointments, and notes. The PDD can be connected to another electronic device, such as a personal computer, for exchanging information with the other device.

While many PDDs are desirable because they are compact and portable, one drawback of typical prior art PDDs is that they use specialized writing systems that can be awkward to learn and may be hard for some users to master. Also, in typical prior art PDDs markings do not appear on the resistive contact surface during writing thereon. As a result, it can be difficult for users to track their writing motions to obtain the correct characters. Furthermore, non-character

marks typically cannot be made or stored in prior art PDDs. Thus, drawings cannot be entered into the PDD. In addition, a PDD user typically enters characters one at a time, significantly limiting the speed with which one can take notes or record information. Therefore, a need exists for a PDD which allows users to write in a more fluid and familiar manner and to include non-  
5 characters in their writing. In other words, a need exists for a PDD that records free-hand writing and/or drawing.

Various devices have been developed to convert written documents into electronic forms in order to reduce storage space and retrieval time. For example, scanners can convert previously existing documents into an electronic format for storage and retrieval. In addition, a personal  
10 computer using certain software packages can allow a user to input data, e.g., to create an original document such as a drawing. The user can input data in a variety of ways, e.g., using a mouse on a desktop. The personal computer can display the original document on a screen. Furthermore, the personal computer can store the input data in memory or on a magnetic storage disk.

Similarly, computers with touch screens and pads allow a user to create input data, e.g., to  
15 create an original document such as a handwritten note or a drawing, using a finger or stylus. Again, the computer can display the document on a screen and/or store it in an electronic format. However, creating an original document using one of these methods is somewhat awkward. The instrument used to mark on the touch screen or pad does not make a mark, and typically the user  
20 has to watch a separate display screen to observe what is recorded as a result of the writing motion.

A.T. Cross of Lincoln R.I. has a product, sold under the name Crosspad<sup>®</sup>, which converts handwritten documents into electronic form. The product includes a conventional notepad  
25 combined with a unique pen and printed circuit board assembly ("PCBA") for the notepad. The user writes on the pad using the pen. The pen has an ink tip which can be used to make marks on the pad. The pen also includes a RF transmitter. The RF transmitter operates in conjunction with the PCBA for the pad to translate pen movement into electronic signals representing the user's writing motion. A switch in the pen turns the transmitter on when the pen is in contact with the pad. The switch is activated as a result of the force exerted by the pad on the tip of the  
30 pen. This system can be used to make electronic copies of handwritten notes. The electronic copies can then be stored and retrieved for later use. The user can write on the pad in an ordinary manner.

However, a need still remains for a system which allows storage, retrieval and searching of content in electronic copies of handwritten information. In addition, a need exists for a

portable PDD system that allows for the creation, storage, searching, and retrieval of handwritten information.

### SUMMARY OF THE INVENTION

5 An object of the present invention is to set forth a palm pad system that overcomes deficiencies and limitations of the prior art.

In accordance with embodiments of the present invention, the palm pad system comprises an electronic notepad coupled to a conventional PDD. The electronic notepad and the PDD are retained in position on a common base. The electronic notepad includes an integrated printed  
10 circuit board having a plurality of etched loops formed thereon. The etched loops are uniformly distributed over the surface of the board and define an X-grid pattern and a Y-grid pattern. The X-grid pattern and Y-grid pattern are receptive to signals generated by a source, which source is positioned in close proximity to the grid patterns defined on the notepad. The electronic notepad further includes a paper-pad, which is securely mounted adjacent to the printed circuit board.

15 The source for generating the signals can be an electromechanical transmitter, which transmitter is mounted in an elongated pen. The pen further includes a first end having a conventional retractable writing tip, such as a ball point pen tip, for marking on paper. The writing tip is coupled to the electromechanical transmitter via a micro-switch. The micro-switch is pressure actuated so that when the writing tip is pressed against a writing surface, such as the  
20 paper-pad, the transmitter coupled therewith is enabled for generating the signal. The signal is sensed by the X-grid pattern and the Y-grid pattern. The signal sensed by the X-grid pattern and the Y-grid pattern is further processed by electronics coupled therewith to determine the relative location of the writing tip with respect to the paper-pad. When a user composes handwritten data by moving the writing tip of the pen over the paper-pad, the relative locations of the writing tip  
25 are processed to concomitantly reproduce and electronically display the handwritten data on a display associated with the PDD. The electronically reproduced data can further be saved as an electronic file, which file can be retrieved at a later time.

The pen further includes a cap having an aperture with a retractable non-writing tip mounted therein. When the cap is positioned over the writing tip, which is defined at the first  
30 end of the pen, the non-writing tip cooperates with the first end of the pen to force the non-writing tip into a retracted position defined in the cap. When the cap is positioned over a second end of the pen, the non-writing tip cooperates with the second end of the pen to force the non-writing tip, which tip is defined in the cap, to extend outwardly from the aperture defined on the cap.

In another embodiment, the palm pad system for enabling a user to electronically display, store, and retrieve hand written data comprises a means for converting handwritten data into an electronic file. The means for converting handwritten data into an electronic file is retained on a base. The palm pad system further comprises a means for receiving and processing the electronic  
5 file. The means for receiving and processing the electronic file is also retained on the base. The means for receiving and processing the electronic file is constructed and arranged to display, store, and retrieve the electronic file. In an embodiment, the means for receiving and processing the electronic file comprises a means for displaying the electronic file; a means for storing the electronic file; a means for retrieving the electronic file; and a control means for controlling the  
10 displaying, storing and retrieving of the electronic file.

#### BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objects of this invention, the various features thereof, as well as the invention itself, may be more fully understood from the following description, when read  
15 together with the accompanying drawings in which:

Fig. 1 (a) is a planar view of a palm pad system in accordance with one embodiment of the present invention;

Fig. 1 (b) is a planar view of an integrated printed circuit board assembly included in the palm pad system shown in Fig. 1 (a);

20 Fig. 2 (a) is an isometric view of the palm pad system shown in Fig. 1 (a);

Fig. 2 (b) is a folded view of the palm pad system shown in Fig. 2 (a);

Fig. 2 (c) is a side view of the palm pad system shown in Fig. 2 (b);

Fig. 3 (a) is an isometric view of one embodiment of a pen, which is adapted to cooperate with the palm pad system of Fig. 1 (a);

25 Fig. 3 (b) is a cross sectional view of the pen shown in Fig. 3 (a);

Fig. 4 (a) is an isometric view of another embodiment of a pen, which is adapted to cooperate with the palm pad system of the present invention;

Fig. 4 (b) is a cross sectional view of the pen shown in Fig. 4 (a);

30 Figs. 5 (a), 5 (b), 5 (c), and 5 (d) shows various views of a PDD integrated with a flip-down electronic notepad in accordance with another embodiment of the present invention;

Fig. 6 is an isometric view of a laptop computer integrated with an electronic notepad; and

Fig. 7 is a planar view of a fully integrated palm pad system.

### DETAILED DESCRIPTION

In accordance with embodiments of the present invention, a portable palm pad system is set forth for enabling a user to electronically display, store, and retrieve hand written data.

Referring to Fig. 1 (a), portable palm pad system 5 in accordance with one embodiment of the present invention comprises electronic notepad 10 coupled to a conventional PDD 15. Palm pad system 5 further includes pen 200, which is shown in Figs. 3 and 4, and will be described in detail later. Referring again to Fig. 1 (a), one example of a conventional PDD 15 is a Palm Pilot™ which is manufactured by 3COM. Electronic notepad 10 and PDD 15 coupled therewith are mounted on common base 20. Generally, PDD 15 includes a microprocessor (not shown), memory (not shown), display area 25 and input area 30. Display area 25 is typically comprised of a touch sensitive liquid crystal display ("LCD") 25a. Input area 30 typically has a number of control buttons 30a which a user can actuate to enter or display data on LCD 25a. When displaying data on the touch sensitive LCD 25a associated with PDD 15 or when entering data into PDD 15 via control buttons 30a or touch sensitive LCD 25a, conventional software, which is stored in the memory defined in PDD 15, is executed to manage data entry or data displaying operations. One example of such software is IBM's Ink Manager™ software, which provides note editing, searching, organization and sharing tools. The control buttons 30a, LCD 25a and software are all associated with the PDD 15 and are known to those of ordinary skill in the art.

Referring further to Fig. 1 (b), electronic notepad 10 defined on palm pad system 5 includes integrated printed circuit board assembly ("PCBA") 35 adapted to securely hold an ordinary paper-pad 40 thereon. Paper-pad 40 can be written on just like any other ordinary paper-pad. PCBA 35 includes a plurality of etched loops 36 formed thereon. Etched loops 36 are uniformly distributed over the surface of PCBA 35 and form an X-grid pattern (not shown) and a Y-grid pattern (not shown). The X-grid pattern and the Y-grid pattern are coupled with position determining electronics (not shown). The PCBA 35 is powered parasitically through data bus 45 to PDD 15. Of course, many other methods can be employed to provide power to PCBA 35, including a separate power source. In an embodiment, the notepad includes four AAA batteries (not shown) that allow the notepad to operate for 3-4 months with moderate use.

Electronic notepad 10 and PDD 15 are coupled through an interface 50. According to an embodiment of the invention, interface 50 is a standard RS232 interface. As noted above, notepad 10 and PDD 15 can use a variety of communications technologies. PCBA 35 contained within notepad 10 transmits position and status information to PDD 15 through the interface 50 via data bus 45. The position and status information can include separate X and Y coordinates of

pen 200 (Figs. 3 and 4), which is adapted to cooperate with notepad 10, and the status of micro-switch 240 (Figs. 3 and 4) contained pen 200 (Figs. 3 and 4). Furthermore, information directed to actuation of various controls on notepad 55 can be communicated to PDD 15. Although not shown in the drawings, other interfaces can be employed to form a communication channel  
5 between electronic notepad 10 and PDD 15, for example, a substantially flat interface (not shown) can be integrated with the common base 20.

PDD 15 further includes software which operates to interpret the position and status information provided by PCBA 35. The software converts the position and status information received from PCBA 35 into an electronic copy of markings or writings composed by a user on  
10 paper-pad 40. The electronic copy of the markings or writings composed by the user can then be stored, retrieved and/or displayed on PDD 15, as with any other data received by the PDD. Alternatively, notepad 10 can include software or hardware for processing the position and status information to create electronic copies of markings or writings composed on the pad by a user. Then, only the electronic copies would be transferred to PDD 15 for storage, retrieval and  
15 display.

Referring to Fig. 2 (a), in an embodiment of the present invention, common base 20 includes PDD retaining surface 20a and notepad retaining surface 20b. Common base 20 can be formed of various materials including: leather, ballistic nylon and synthetics. PDD retaining surface 20a and notepad retaining surface 20b are coupled by a flexible section 20c. Flap 60  
20 defined on common base 20 substantially encloses and protects interface 50 (Fig. 1 (a)), which enables communication between PDD 15 and notepad 10 via data bus 45. Both PDD retaining surface 20a and notepad retaining surface 20b can be folded towards each other, which bends flexible section 20c to orient the common base 20 into a folded position as shown in Fig. 2 (b). At least one tab 65, with an appropriate closure mechanism can be used to hold common base 20  
25 in the folded position as shown in Fig. 2 (c). Fig. 2 (c) further shows a set of loops 70 defined on flexible portion 20c of common base 20. When common base 20 is folded, loops 70 form a space 70a. Space 70a can accommodate a cylindrical object such as pen 200 (Figs. 3 and 4). Common base 20 further includes an additional power supply retaining structure 75 adapted to retain batteries (not shown) or other power supply in a secure position defined on common base  
30 20.

Figs. 3 (a) and 3 (b); 4 (a) and 4 (b) show embodiments of a pen 200 used in conjunction with embodiments of the present invention. U.S. Patent No. 5,434,371, issued to Brooks and incorporated herein by reference, teaches a hand-held electronic writing implement including a writing tip for marking a surface and a pressure sensor located at the writing tip for emitting a

pressure signal once the writing tip contacts the writing surface. Furthermore, U.S. Patent No. 5,635,682 issued to Cherdak et al. and incorporated herein by reference, teaches a wireless stylus and disposable stylus cartridge for use with a pen computing device. The hand-held electronic writing implement set forth in U.S. Patent No. 5,434,371 and the wireless stylus and disposable stylus cartridge set forth in U.S. Patent No. 5,635,682 can be adapted for use with embodiments of the present invention.

In an embodiment of the present invention, the pen 200 includes an ordinary writing tip 205 defined at a first end 206 of the pen, which writing tip 205 can write on paper pad 40 (Fig. 1 (a)), and rubber tip 210 or non-writing tip which makes no marks. More specifically and referring to Fig. 1 (a) as well as to Figs. 3 (a) and 3 (b), pen 200 includes body 215 and cap 220. The body 215 houses ink supply 225 connected to writing tip 205. Ink supply 225 and writing tip 205 can be comprised of many ordinary forms for pens, such as a replaceable cartridge with a ball point tip. Body 215 also houses electromechanical transmitter 230. Transmitter 230 provides a signal used by notepad 10 to determine the status and position of pen 200. The signal is frequency encoded to relay the status of writing tip 205 and a side switch (not shown). All frequencies are set within the frequency range of 335 to 500 kHz, and are assigned in a manner to allow enough tolerance to eliminate the need for tuning each pen 200. The status of writing tip 205 is determined by micro switching mechanism 235. Switching mechanism 235 is operable when writing tip 205 contacts paper pad 40. The pressure of writing tip 205 on paper pad 40 is sufficient to activate switch 235 and transmitter 230.

Non-writing tip 210 is retractably mounted in cap 220 and is adapted for use with the touch sensitive display 25a which is associated with PDD 15. When cap 220 is positioned over writing tip 205, non-writing tip 210 is retracted within cap 220 as shown in Fig. 3 (b). When cap 220 is positioned over second end 207 of pen 200, which is defined diametrically opposite from writing tip 221, second end 207 thereof cooperates with non-writing tip 210 to force non-writing tip 210 to extend outwardly from aperture 221 defined on cap 220 as shown in Figs 4 (a) and 4 (b). Therefore, when the user removes cap 220 from writing tip 205 to begin writing on notepad 10, the user can also position cap 220 over second end 207 of pen 200 to extend non-writing tip 210 outwardly from aperture 221 defined on cap 220, which non-writing tip 210 can be used to operate touch sensitive display 25a and/or control buttons 30a (Fig. 1 (a)) associated with PDD 15. Pen 200 can include a single AAA battery 240, which provides pen 200 with a 6-12 month average life.

During use of writing tip 205, writing tip 205 is pressed against paper-pad 40 for actuating micro-switch 235 to enable transmitter 230 to provide a signal. The signal provided by

transmitter 230 is communicated to the etched loops 36 defined on PCBA 35. The relative amplitudes of the received signals on individual etched loops 36 are used as inputs to algorithms (not shown) which determine writing tip's 205 relative location on paper-pad 40. Therefore, when a user composes handwritten data by moving writing tip 205 of pen 200 over paper-pad 40, the algorithms determine writing tip's 205 relative location on paper-pad 40. The relative locations of writing tip 205 are further processed to concomitantly reproduce and electronically display the handwritten data on display 25a associated with PDD 15. The electronically reproduced data can further be saved as an electronic file, which file can be retrieved at a later time. More simply stated, a user's hand written notes, which are written on paper-pad 40, are concomitantly displayed on touch sensitive display 25a associated with PDD 15. Thereafter, the user's handwritten notes can be electronically stored to and retrieved from memory which is associated with PDD 15.

Figs. 5 (a), 5 (b), 5 (c), and 5 (d) show various views of another embodiment of palm pad system 5b according to principles of the present invention. More specifically and referring to Fig. 5 (a), palm pad system 5b includes a conventional PDD 15b having a pivotal flip-down connection 17 to electronic notepad 10b. A flexible data communication bus (not shown) connected between PDD 15b and notepad 10b enables data communication between PDD 15b and notepad 10b. Fig. 5 (b) is a side view of palm pad system 5b. Fig. 5 (c) shows palm pad system 5b in a closed position. Fig. 5 (d) is an isometric view of palm pad system 5b positioned in a user's hand during use.

Referring to Fig. 6, another embodiment of the present invention includes the integration of electronic notepad 10c with laptop computer 300. Electronic notepad 10c can be coupled to a conventional processor (not shown) as well as conventional memory (not shown) contained within laptop computer 10c. Such a configuration allows a user to take handwritten notes on electronic notepad 10c and electronically store the notes in laptop computer 300. Thereafter, the stored notes can be retrieved and displayed on a screen 310 associated with laptop computer 300.

Referring to Fig. 7, another embodiment of the present invention includes a fully integrated palm pad system 5C. Integrated palm pad system 5C includes a substantially rigid housing 400 containing electronic notepad 10d and PDD 15d. Electronic notepad 10d is positioned adjacent to a first window defined on housing 400 and PDD 15d is positioned adjacent to a second window defined on housing 400. Although not shown in Fig. 7, the electronic notepad 10d and PDD 15d are coupled together by a data bus which operates in a similar manner as that previously described in earlier embodiments.



The above described palm pad system 5 has many advantages over the prior art such as enabling handwritten notes to be converted into an electronic file or pages which can be stored and/or retrieved in the memory of PDD 15. The electronic file can further be displayed on a touch sensitive display 25a associated with PDD 15.

- 5       The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are therefore to be considered in respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of the equivalency of the claims are therefore intended to be embraced
- 10   therein.

FIG. 1  
FIG. 2  
FIG. 3  
FIG. 4  
FIG. 5  
FIG. 6  
FIG. 7  
FIG. 8  
FIG. 9  
FIG. 10  
FIG. 11  
FIG. 12  
FIG. 13  
FIG. 14  
FIG. 15  
FIG. 16  
FIG. 17  
FIG. 18  
FIG. 19  
FIG. 20  
FIG. 21  
FIG. 22  
FIG. 23  
FIG. 24  
FIG. 25  
FIG. 26  
FIG. 27  
FIG. 28  
FIG. 29  
FIG. 30  
FIG. 31  
FIG. 32  
FIG. 33  
FIG. 34  
FIG. 35  
FIG. 36  
FIG. 37  
FIG. 38  
FIG. 39  
FIG. 40  
FIG. 41  
FIG. 42  
FIG. 43  
FIG. 44  
FIG. 45  
FIG. 46  
FIG. 47  
FIG. 48  
FIG. 49  
FIG. 50  
FIG. 51  
FIG. 52  
FIG. 53  
FIG. 54  
FIG. 55  
FIG. 56  
FIG. 57  
FIG. 58  
FIG. 59  
FIG. 60  
FIG. 61  
FIG. 62  
FIG. 63  
FIG. 64  
FIG. 65  
FIG. 66  
FIG. 67  
FIG. 68  
FIG. 69  
FIG. 70  
FIG. 71  
FIG. 72  
FIG. 73  
FIG. 74  
FIG. 75  
FIG. 76  
FIG. 77  
FIG. 78  
FIG. 79  
FIG. 80  
FIG. 81  
FIG. 82  
FIG. 83  
FIG. 84  
FIG. 85  
FIG. 86  
FIG. 87  
FIG. 88  
FIG. 89  
FIG. 90  
FIG. 91  
FIG. 92  
FIG. 93  
FIG. 94  
FIG. 95  
FIG. 96  
FIG. 97  
FIG. 98  
FIG. 99  
FIG. 100  
FIG. 101  
FIG. 102  
FIG. 103  
FIG. 104  
FIG. 105  
FIG. 106  
FIG. 107  
FIG. 108  
FIG. 109  
FIG. 110  
FIG. 111  
FIG. 112  
FIG. 113  
FIG. 114  
FIG. 115  
FIG. 116  
FIG. 117  
FIG. 118  
FIG. 119  
FIG. 120  
FIG. 121  
FIG. 122  
FIG. 123  
FIG. 124  
FIG. 125  
FIG. 126  
FIG. 127  
FIG. 128  
FIG. 129  
FIG. 130  
FIG. 131  
FIG. 132  
FIG. 133  
FIG. 134  
FIG. 135  
FIG. 136  
FIG. 137  
FIG. 138  
FIG. 139  
FIG. 140  
FIG. 141  
FIG. 142  
FIG. 143  
FIG. 144  
FIG. 145  
FIG. 146  
FIG. 147  
FIG. 148  
FIG. 149  
FIG. 150  
FIG. 151  
FIG. 152  
FIG. 153  
FIG. 154  
FIG. 155  
FIG. 156  
FIG. 157  
FIG. 158  
FIG. 159  
FIG. 160  
FIG. 161  
FIG. 162  
FIG. 163  
FIG. 164  
FIG. 165  
FIG. 166  
FIG. 167  
FIG. 168  
FIG. 169  
FIG. 170  
FIG. 171  
FIG. 172  
FIG. 173  
FIG. 174  
FIG. 175  
FIG. 176  
FIG. 177  
FIG. 178  
FIG. 179  
FIG. 180  
FIG. 181  
FIG. 182  
FIG. 183  
FIG. 184  
FIG. 185  
FIG. 186  
FIG. 187  
FIG. 188  
FIG. 189  
FIG. 190  
FIG. 191  
FIG. 192  
FIG. 193  
FIG. 194  
FIG. 195  
FIG. 196  
FIG. 197  
FIG. 198  
FIG. 199  
FIG. 200  
FIG. 201  
FIG. 202  
FIG. 203  
FIG. 204  
FIG. 205  
FIG. 206  
FIG. 207  
FIG. 208  
FIG. 209  
FIG. 210  
FIG. 211  
FIG. 212  
FIG. 213  
FIG. 214  
FIG. 215  
FIG. 216  
FIG. 217  
FIG. 218  
FIG. 219  
FIG. 220  
FIG. 221  
FIG. 222  
FIG. 223  
FIG. 224  
FIG. 225  
FIG. 226  
FIG. 227  
FIG. 228  
FIG. 229  
FIG. 230  
FIG. 231  
FIG. 232  
FIG. 233  
FIG. 234  
FIG. 235  
FIG. 236  
FIG. 237  
FIG. 238  
FIG. 239  
FIG. 240  
FIG. 241  
FIG. 242  
FIG. 243  
FIG. 244  
FIG. 245  
FIG. 246  
FIG. 247  
FIG. 248  
FIG. 249  
FIG. 250  
FIG. 251  
FIG. 252  
FIG. 253  
FIG. 254  
FIG. 255  
FIG. 256  
FIG. 257  
FIG. 258  
FIG. 259  
FIG. 260  
FIG. 261  
FIG. 262  
FIG. 263  
FIG. 264  
FIG. 265  
FIG. 266  
FIG. 267  
FIG. 268  
FIG. 269  
FIG. 270  
FIG. 271  
FIG. 272  
FIG. 273  
FIG. 274  
FIG. 275  
FIG. 276  
FIG. 277  
FIG. 278  
FIG. 279  
FIG. 280  
FIG. 281  
FIG. 282  
FIG. 283  
FIG. 284  
FIG. 285  
FIG. 286  
FIG. 287  
FIG. 288  
FIG. 289  
FIG. 290  
FIG. 291  
FIG. 292  
FIG. 293  
FIG. 294  
FIG. 295  
FIG. 296  
FIG. 297  
FIG. 298  
FIG. 299  
FIG. 300  
FIG. 301  
FIG. 302  
FIG. 303  
FIG. 304  
FIG. 305  
FIG. 306  
FIG. 307  
FIG. 308  
FIG. 309  
FIG. 310  
FIG. 311  
FIG. 312  
FIG. 313  
FIG. 314  
FIG. 315  
FIG. 316  
FIG. 317  
FIG. 318  
FIG. 319  
FIG. 320  
FIG. 321  
FIG. 322  
FIG. 323  
FIG. 324  
FIG. 325  
FIG. 326  
FIG. 327  
FIG. 328  
FIG. 329  
FIG. 330  
FIG. 331  
FIG. 332  
FIG. 333  
FIG. 334  
FIG. 335  
FIG. 336  
FIG. 337  
FIG. 338  
FIG. 339  
FIG. 340  
FIG. 341  
FIG. 342  
FIG. 343  
FIG. 344  
FIG. 345  
FIG. 346  
FIG. 347  
FIG. 348  
FIG. 349  
FIG. 350  
FIG. 351  
FIG. 352  
FIG. 353  
FIG. 354  
FIG. 355  
FIG. 356  
FIG. 357  
FIG. 358  
FIG. 359  
FIG. 360  
FIG. 361  
FIG. 362  
FIG. 363  
FIG. 364  
FIG. 365  
FIG. 366  
FIG. 367  
FIG. 368  
FIG. 369  
FIG. 370  
FIG. 371  
FIG. 372  
FIG. 373  
FIG. 374  
FIG. 375  
FIG. 376  
FIG. 377  
FIG. 378  
FIG. 379  
FIG. 380  
FIG. 381  
FIG. 382  
FIG. 383  
FIG. 384  
FIG. 385  
FIG. 386  
FIG. 387  
FIG. 388  
FIG. 389  
FIG. 390  
FIG. 391  
FIG. 392  
FIG. 393  
FIG. 394  
FIG. 395  
FIG. 396  
FIG. 397  
FIG. 398  
FIG. 399  
FIG. 400  
FIG. 401  
FIG. 402  
FIG. 403  
FIG. 404  
FIG. 405  
FIG. 406  
FIG. 407  
FIG. 408  
FIG. 409  
FIG. 410  
FIG. 411  
FIG. 412  
FIG. 413  
FIG. 414  
FIG. 415  
FIG. 416  
FIG. 417  
FIG. 418  
FIG. 419  
FIG. 420  
FIG. 421  
FIG. 422  
FIG. 423  
FIG. 424  
FIG. 425  
FIG. 426  
FIG. 427  
FIG. 428  
FIG. 429  
FIG. 430  
FIG. 431  
FIG. 432  
FIG. 433  
FIG. 434  
FIG. 435  
FIG. 436  
FIG. 437  
FIG. 438  
FIG. 439  
FIG. 440  
FIG. 441  
FIG. 442  
FIG. 443  
FIG. 444  
FIG. 445  
FIG. 446  
FIG. 447  
FIG. 448  
FIG. 449  
FIG. 450  
FIG. 451  
FIG. 452  
FIG. 453  
FIG. 454  
FIG. 455  
FIG. 456  
FIG. 457  
FIG. 458  
FIG. 459  
FIG. 460  
FIG. 461  
FIG. 462  
FIG. 463  
FIG. 464  
FIG. 465  
FIG. 466  
FIG. 467  
FIG. 468  
FIG. 469  
FIG. 470  
FIG. 471  
FIG. 472  
FIG. 473  
FIG. 474  
FIG. 475  
FIG. 476  
FIG. 477  
FIG. 478  
FIG. 479  
FIG. 480  
FIG. 481  
FIG. 482  
FIG. 483  
FIG. 484  
FIG. 485  
FIG. 486  
FIG. 487  
FIG. 488  
FIG. 489  
FIG. 490  
FIG. 491  
FIG. 492  
FIG. 493  
FIG. 494  
FIG. 495  
FIG. 496  
FIG. 497  
FIG. 498  
FIG. 499  
FIG. 500  
FIG. 501  
FIG. 502  
FIG. 503  
FIG. 504  
FIG. 505  
FIG. 506  
FIG. 507  
FIG. 508  
FIG. 509  
FIG. 510  
FIG. 511  
FIG. 512  
FIG. 513  
FIG. 514  
FIG. 515  
FIG. 516  
FIG. 517  
FIG. 518  
FIG. 519  
FIG. 520  
FIG. 521  
FIG. 522  
FIG. 523  
FIG. 524  
FIG. 525  
FIG. 526  
FIG. 527  
FIG. 528  
FIG. 529  
FIG. 530  
FIG. 531  
FIG. 532  
FIG. 533  
FIG. 534  
FIG. 535  
FIG. 536  
FIG. 537  
FIG. 538  
FIG. 539  
FIG. 540  
FIG. 541  
FIG. 542  
FIG. 543  
FIG. 544  
FIG. 545  
FIG. 546  
FIG. 547  
FIG. 548  
FIG. 549  
FIG. 550  
FIG. 551  
FIG. 552  
FIG. 553  
FIG. 554  
FIG. 555  
FIG. 556  
FIG. 557  
FIG. 558  
FIG. 559  
FIG. 560  
FIG. 561  
FIG. 562  
FIG. 563  
FIG. 564  
FIG. 565  
FIG. 566  
FIG. 567  
FIG. 568  
FIG. 569  
FIG. 570  
FIG. 571  
FIG. 572  
FIG. 573  
FIG. 574  
FIG. 575  
FIG. 576  
FIG. 577  
FIG. 578  
FIG. 579  
FIG. 580  
FIG. 581  
FIG. 582  
FIG. 583  
FIG. 584  
FIG. 585  
FIG. 586  
FIG. 587  
FIG. 588  
FIG. 589  
FIG. 590  
FIG. 591  
FIG. 592  
FIG. 593  
FIG. 594  
FIG. 595  
FIG. 596  
FIG. 597  
FIG. 598  
FIG. 599  
FIG. 600  
FIG. 601  
FIG. 602  
FIG. 603  
FIG. 604  
FIG. 605  
FIG. 606  
FIG. 607  
FIG. 608  
FIG. 609  
FIG. 610  
FIG. 611  
FIG. 612  
FIG. 613  
FIG. 614  
FIG. 615  
FIG. 616  
FIG. 617  
FIG. 618  
FIG. 619  
FIG. 620  
FIG. 621  
FIG. 622  
FIG. 623  
FIG. 624  
FIG. 625  
FIG. 626  
FIG. 627  
FIG. 628  
FIG. 629  
FIG. 630  
FIG. 631  
FIG. 632  
FIG. 633  
FIG. 634  
FIG. 635  
FIG. 636  
FIG. 637  
FIG. 638  
FIG. 639  
FIG. 640  
FIG. 641  
FIG. 642  
FIG. 643  
FIG. 644  
FIG. 645  
FIG. 646  
FIG. 647  
FIG. 648  
FIG. 649  
FIG. 650  
FIG. 651  
FIG. 652  
FIG. 653  
FIG. 654  
FIG. 655  
FIG. 656  
FIG. 657  
FIG. 658  
FIG. 659  
FIG. 660  
FIG. 661  
FIG. 662  
FIG. 663  
FIG. 664  
FIG. 665  
FIG. 666  
FIG. 667  
FIG. 668  
FIG. 669  
FIG. 670  
FIG. 671  
FIG. 672  
FIG. 673  
FIG. 674  
FIG. 675  
FIG. 676  
FIG. 677  
FIG. 678  
FIG. 679  
FIG. 680  
FIG. 681  
FIG. 682  
FIG. 683  
FIG. 684  
FIG. 685  
FIG. 686  
FIG. 687  
FIG. 688  
FIG. 689  
FIG. 690  
FIG. 691  
FIG. 692  
FIG. 693  
FIG. 694  
FIG. 695  
FIG. 696  
FIG. 697  
FIG. 698  
FIG. 699  
FIG. 700  
FIG. 701  
FIG. 702  
FIG. 703  
FIG. 704  
FIG. 705  
FIG. 706  
FIG. 707  
FIG. 708  
FIG. 709  
FIG. 710  
FIG. 711  
FIG. 712  
FIG. 713  
FIG. 714  
FIG. 715  
FIG. 716  
FIG. 717  
FIG. 718  
FIG. 719  
FIG. 720  
FIG. 721  
FIG. 722  
FIG. 723  
FIG. 724  
FIG. 725  
FIG. 726  
FIG. 727  
FIG. 728  
FIG. 729  
FIG. 730  
FIG. 731  
FIG. 732  
FIG. 733  
FIG. 734  
FIG. 735  
FIG. 736  
FIG. 737  
FIG. 738  
FIG. 739  
FIG. 740  
FIG. 741  
FIG. 742  
FIG. 743  
FIG. 744  
FIG. 745  
FIG. 746  
FIG. 747  
FIG. 748  
FIG. 749  
FIG. 750  
FIG. 751  
FIG. 752  
FIG. 753  
FIG. 754  
FIG. 755  
FIG. 756  
FIG. 757  
FIG. 758  
FIG. 759  
FIG. 760  
FIG. 761  
FIG. 762  
FIG. 763  
FIG. 764  
FIG. 765  
FIG. 766  
FIG. 767  
FIG. 768  
FIG. 769  
FIG. 770  
FIG. 771  
FIG. 772  
FIG. 773  
FIG. 774  
FIG. 775  
FIG. 776  
FIG. 777  
FIG. 778  
FIG. 779  
FIG. 780  
FIG. 781  
FIG. 782  
FIG. 783  
FIG. 784  
FIG. 785  
FIG. 786  
FIG. 787  
FIG. 788  
FIG. 789  
FIG. 790  
FIG. 791  
FIG. 792  
FIG. 793  
FIG. 794  
FIG. 795  
FIG. 796  
FIG. 797  
FIG. 798  
FIG. 799  
FIG. 800  
FIG. 801  
FIG. 802  
FIG. 803  
FIG. 804  
FIG. 805  
FIG. 806  
FIG. 807  
FIG. 808  
FIG. 809  
FIG. 810  
FIG. 811  
FIG. 812  
FIG. 813  
FIG. 814  
FIG. 815  
FIG. 816  
FIG. 817  
FIG. 818  
FIG. 819  
FIG. 820  
FIG. 821  
FIG. 822  
FIG. 823  
FIG. 824  
FIG. 825  
FIG. 826  
FIG. 827  
FIG. 828  
FIG. 829  
FIG. 830  
FIG. 831  
FIG. 832  
FIG. 833  
FIG. 834  
FIG. 835  
FIG. 836  
FIG. 837  
FIG. 838  
FIG. 839  
FIG. 840  
FIG. 841  
FIG. 842  
FIG. 843  
FIG. 844  
FIG. 845  
FIG. 846  
FIG. 847  
FIG. 848  
FIG. 849  
FIG. 850  
FIG. 851  
FIG. 852  
FIG. 853  
FIG. 854  
FIG. 855  
FIG. 856  
FIG. 857  
FIG. 858  
FIG. 859  
FIG. 860  
FIG. 861  
FIG. 862  
FIG. 863  
FIG. 864  
FIG. 865  
FIG. 866  
FIG. 867  
FIG. 868  
FIG. 869  
FIG. 870  
FIG. 871  
FIG. 872  
FIG. 873  
FIG. 874  
FIG. 875  
FIG. 876  
FIG. 877  
FIG. 878  
FIG. 879  
FIG. 880  
FIG. 881  
FIG. 882  
FIG. 883  
FIG. 884  
FIG. 885  
FIG. 886  
FIG. 887  
FIG. 888  
FIG. 889  
FIG. 890  
FIG. 891  
FIG. 892  
FIG. 893  
FIG. 894  
FIG. 895  
FIG. 896  
FIG. 897  
FIG. 898  
FIG. 899  
FIG. 900  
FIG. 901  
FIG. 902  
FIG. 903  
FIG. 904  
FIG. 905  
FIG. 906  
FIG. 907  
FIG. 908  
FIG. 909  
FIG. 910  
FIG. 911  
FIG. 912  
FIG. 913  
FIG. 914  
FIG. 915  
FIG. 916  
FIG. 917  
FIG. 918  
FIG. 919  
FIG. 920  
FIG. 921  
FIG. 922  
FIG. 923  
FIG. 924  
FIG. 925  
FIG. 926  
FIG. 927  
FIG. 928  
FIG. 929  
FIG. 930  
FIG. 931  
FIG. 932  
FIG. 933  
FIG. 934  
FIG. 935  
FIG. 936  
FIG. 937  
FIG. 938  
FIG. 939  
FIG. 940  
FIG. 941  
FIG. 942  
FIG. 943  
FIG. 944  
FIG. 945  
FIG. 946  
FIG. 947  
FIG. 948  
FIG. 949  
FIG. 950  
FIG. 951  
FIG. 952  
FIG. 953  
FIG. 954  
FIG. 955  
FIG. 956  
FIG. 957  
FIG. 958  
FIG. 959  
FIG. 960  
FIG. 961  
FIG. 962  
FIG. 963  
FIG. 964  
FIG. 965  
FIG. 966  
FIG. 967  
FIG. 968  
FIG. 969  
FIG. 970  
FIG. 971  
FIG. 972  
FIG. 973  
FIG. 974  
FIG. 975  
FIG. 976  
FIG. 977  
FIG. 978  
FIG. 979  
FIG. 980  
FIG. 981  
FIG. 982  
FIG. 983  
FIG. 984  
FIG. 985  
FIG. 986  
FIG. 987  
FIG. 988  
FIG. 989  
FIG. 990  
FIG. 991  
FIG. 992  
FIG. 993  
FIG. 994  
FIG. 995  
FIG. 996  
FIG. 997  
FIG. 998  
FIG. 999  
FIG. 1000